

Impact of increased back pressure by exhaust gas treatment systems

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1 Background

This Technical Information Note (TIN) outlines the engine performance and the related influence of increased exhaust gas back pressure due to the installation of an exhaust gas treatment system, such as SO_x scrubber or LP-SCR system.

2 Exhaust system back pressure

2.1 Standard back pressure

The reference design back pressure for WinGD engines is 300 mmWC at 100% power and ISO ambient conditions. This is the standard back pressure, accounting for the pressure drop in the exhaust system from piping, economiser, etc. This standard back pressure does not include any exhaust gas treatment systems that are described in the following sections.

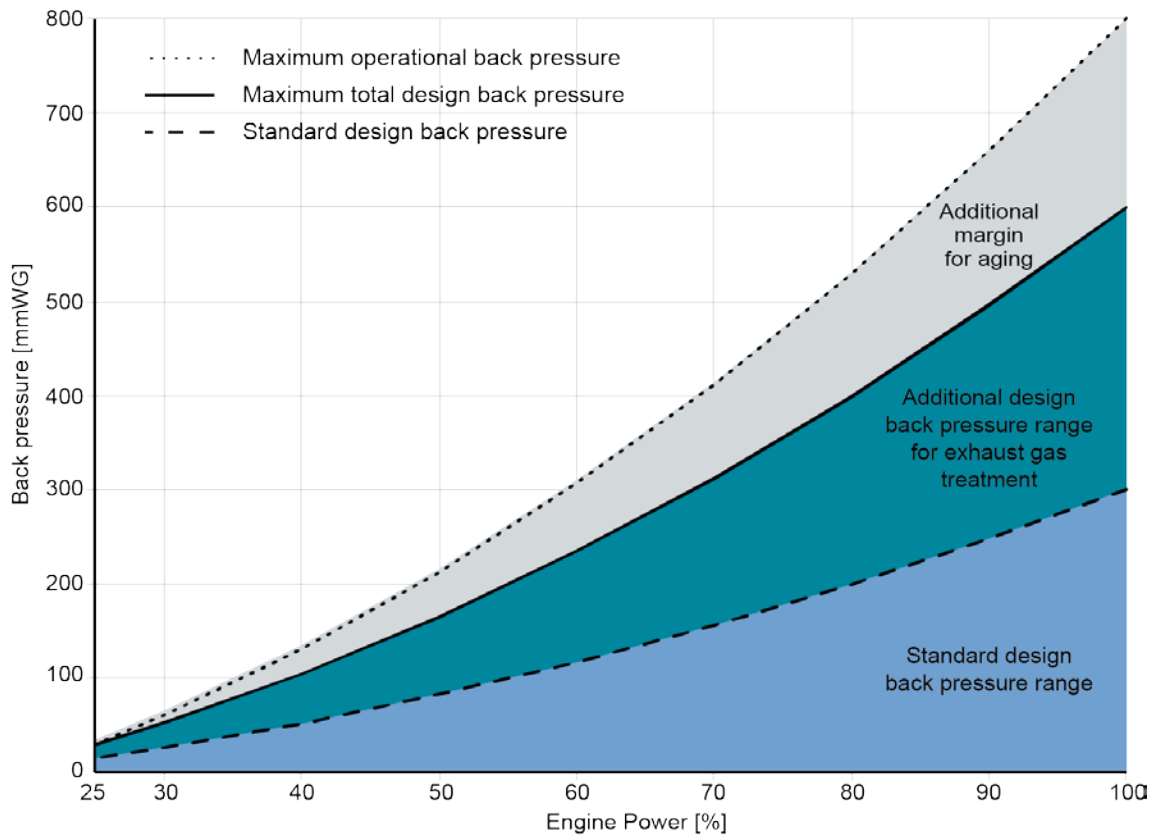
2.2 Additional back pressure

Exhaust gas treatment systems, such as SO_x scrubbers or LP-SCR systems, are installed in the exhaust system after the engine and may increase the back pressure beyond the standard design limit of 300 mmWC at 100% operating power.

However, the allowable increase in back pressure from an exhaust gas treatment installation cannot exceed an additional 300 mmWC at 100% power and ISO ambient conditions.

2.3 Total back pressure of the exhaust system

The total exhaust system back pressure is generated by combining the standard design back pressure of the exhaust system with the additional back pressure generated from an exhaust gas treatment system. The maximum allowable design back pressure is 600 mmWC.



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Figure 1: Exhaust gas system back pressure range

3 Influence on engine performance

The installation of an exhaust gas treatment system will influence the engine performance, such as specific fuel oil consumption, exhaust gas flow and temperature. These performance values can be calculated in the GTD application by entering the additional backpressure in the appropriate fields under the tab “Auxiliary Systems”. The performance data in GTD will be adapted accordingly and no further ISO correction with regard to increased backpressure is required.

The screenshot shows the 'Auxiliary Systems' configuration page in the GTD software. At the top, there are three navigation tabs: 'Select', 'Configure', and 'Auxiliary Systems' (which is highlighted in red). Below the tabs, the configuration is organized into sections. The 'SCR LP' section has three options: 'Bypass fixed rate' (radio button), 'Exhaust gas temperature after bypass' (radio button, selected, with a dropdown menu showing '235 °C'), and 'SCR backpressure' (input field showing '300 mmWC'). The 'Scrubber' section has two options: 'Tier II only' (radio button, selected) and 'Tier II and III' (radio button), and a 'Scrubber backpressure Tier II' input field showing '300 mmWC'.

Figure 2: Exhaust gas treatment system back pressure input in GTD

4 Engine tuning and performance data verification procedure on testbed

4.1 SO_x Scrubber installations

1. For engine tuning and turbocharger matching on the testbed, the exhaust gas back pressure is set to 300 mmWC plus the scrubber’s design pressure drop value at 100% power. When the scrubber design pressure drop is unknown, a total backpressure of 600 mmWC shall be set.
2. Engine performance data are recorded with the exhaust gas backpressure setting left unchanged.
3. Member engines shall be tested with the same backpressure as the parent engine.

4.2 LP-SCR installations without Scrubber

1. For engine tuning and turbocharger matching, the exhaust gas backpressure is set to 300 mmWC at 100% engine power.
2. Tier III mode performance data with SCR in operation are recorded with the exhaust gas backpressure setting left unchanged. The measured total backpressure increases by the additional backpressure of the LP-SCR.
3. Member engines: in cases where Tier III mode is simulated for performance data measurements, the same backpressure shall be adjusted as measured on the parent engine in Tier III mode.

4.3 Overview

	Backpressure at 100% engine power for engine tuning, TC matching and performance data verification in Tier II mode , setting tolerance +/-50 mmWC	Backpressure at 100% engine power for performance data verification in Tier III mode , setting tolerance +/-50 mmWC
Scrubber only	300 mmWC + Scrubber pressure drop or 600 mmWC	-
Scrubber & LP-SCR ¹⁾		300 mmWC + SCR pressure drop
Scrubber & HP-SCR ²⁾		300 mmWC + Scrubber pressure drop or 600 mmWC
LP-SCR only	300 mmWC	300 mmWC + SCR pressure drop
HP-SCR only		300 mmWC

- 1) On Board, either scrubber or LP-SCR in operation. The other must be bypassed
- 2) An HP-SCR does not impact the backpressure after turbocharger.

In case the reference back pressure for performance data verification, as agreed between engine builder and shipyard, differs from the values mentioned in the table above, the measured performance data can be corrected to the agreed reference back pressure by the WinGD ISO correction formulas.